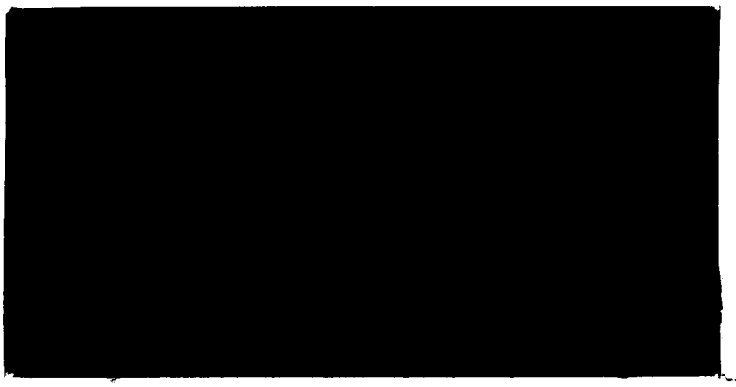

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NEW JERSEY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

OFFICE OF COASTAL ZONE MANAGEMENT

UPLAND WILDLIFE HABITATS:
UPLAND LIVING RESOURCES

A Staff Working Paper

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November, 1976

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Note: This staff working paper is one of a series of Issue and Policy Alternative Papers presenting facts, analyses, and conceptual policy alternatives on coastal resources and coastal land and water uses. The purpose of this draft document is to stimulate discussion and comments that will assist preparation of the management program for the New Jersey coastal zone.

This report was prepared in part with financial assistance from the National Oceanic and Atmospheric Administration under the federal Coastal Zone Management Act, P.L. 92-583.

Comments, criticism, additions, and suggestions are welcome and should be addressed to the New Jersey Office of Coastal Zone Management.

CONTENTS

APPENDICES

INTRODUCTION

Within the uplands of the coastal zone counties (those areas not directly influenced by tidal waters) exists an abundance and diversity of wildlife. This resource is an asset not only to hunters, fishermen, and nature lovers, but also in terms of aesthetic and intrinsic ecological values to the people of the state. This report deals with mammals, birds, reptiles, amphibians and fish found in the upland sections of the New Jersey coastal zone, and problems related to man's destruction of wildlife habitat and use of the wildlife resource.

This paper is intended to further debate on important upland wildlife issues. The first section briefly defines the issues in the coastal area and then presents alternative policies which could be part of the coastal zone management program in New Jersey.

Section III provides characteristics of upland wildlife habitats in New Jersey's coastal area. Natural functions and values of wildlife resources are also discussed. Section IV analyzes human activities and how each affects wildlife.

Three appendices conclude the paper. First, regional reports are presented which highlight specific values and environmental problems in each of the six planning regions. The final two appendices provide tables and references.

I. ISSUE

Human activities are causing considerable alteration and destruction of wildlife habitats and overexploitation of species. Major factors affecting wildlife habitats include forestry, agriculture and urbanization. These activities change habitats, creating opportunities for some wildlife species while driving out others. While the changes brought by forestry and agriculture may be compatible with the existence of diverse wildlife communities, the process of urbanization usually results in decreased wildlife diversity annd numbers.

The major problem relating to the use and maintenance of these wildlife species is the threat of overexploitation. This threatens both non-consuimptive human use (bird watching, photography, etc.) and consumptive use (hunting, fishing, etc.) of wildlife. On the other hand, maintenance of an abundant and varied wildlife resource in a state as densely populated as New Jersey may cause other problems by conflicting with other human activities.

With more than 50% of its land in natural vegetation, New Jersey has significant remaining wildlife habitat resources. Diminishing amounts of open space and anticipated growth and urban development suggests that an attempt should be made to identify important habitats and wildlife species and to minimize the adverse impacts of man's activities.

All major habitat types in New Jersey have suffered losses due to human activity. On the coastline, dunes and barrier beach uplands have received the greatest development pressure. Freshwater wetlands combine heavy human use with vulnerability to degradation and are therefore also of great concern. The Pine Barrens represent a unique community still largely undeveloped whose future is in question. New Jersey's hardwood forests remain extensive, but scattered fields and meadows are ecologically precarious and greatly dependent on human influences.

II. POLICY ALTERNATIVES

1. A program could be instituted to discourage land uses adverse to on-site maintenance of the upland wildlife resource. Criteria could be developed to identify uses which detract from immediate wildlife values. Criteria to be considered include: (a) destruction or preemption of open space, especially freshwater wetlands, barrier beach, lowland forests; (b) vegetative alteration, including limitation of species diversity and alteration of vegetative structure (removal of one or more vegetative strata canopy, understory, ground understory or ground level); (c) alteration of wetlands including water quality, surface or groundwater levels, and drainage patterns; and (d) erosion of soils.

2. Non-tidal wetlands could be protected in a similar manner as tidal wetlands (refer to the New Jersey Wetlands Act of 1970). Protection of upstream drainage areas is critical to the productivity of downstream estuaries. Criteria in order to identify non-tidal wetlands could be based on vegetative species delineated through aerial photography. Upland drainage areas are of critical importance to maintenance of coastal water quality.

3. A general program of discouraging land uses adverse to regional maintenance of the upland wildlife resource could be instituted. Criteria would be developed to

identify land uses that detract from regional wildlife values. Topics would include: (a) breakup of contiguous tracts of wildlife habitat, especially those areas of special value in maintaining the resource; (b) reduction in size of tracts of wildlife habitat below the size necessary to maintain a viable ecosystem; (c) reduction or degradation of valuable habitats whose distribution on a regional basis is already limited, such as barrier beaches and freshwater wetlands; (d) interference with travel or migration routes; (e) degradation of water and wetlands quality; (f) limitation of age, species and structural diversity of forests and patterns of use that limit amounts of "edge" or ecotone; and (g) suppression of natural factors (such as fire) which maintain communities.

4. Specific sites and regions could be given protective status based on their value in maintaining wildlife, value to human use of the wildlife resource and susceptability to human interference. Criteria to consider in evaluating the ability of a site to maintain wildlife include support of diverse and numerous wildlife, endangered, threatened or unique species, and unique natural communities.

   Areas valuable in terms of human use of the wildlife resource could be considered by evaluating the following criteria: intense or frequent use by hunters, fishermen, trappers, birdwatchers and nature lovers; frequent expo-

sure of desirable wildlife to the general public; and potential for high human use because of high wildlife numbers, variety of wildlife, unique wildlife, or location in areas of present or projected future public demand.

Criteria to evaluate areas where wildlife resources are susceptible to human interference could be developed. Such criteria would include vulnerability to chemical pollutants and siltation, potential for soil erosion, proximity and compatibility of surrounding land uses, and vegetative makeup requiring unique environmental conditions such as specific water levels and chemistry or frequent fires.

Mapping of areas of high value could be instituted to provide the reference necessary for control measures. Regional patterns as well as immediate areas could be evaluated.

5. A policy could be designed to encourage desirable consumptive and non-consumptive uses of the wildlife resource.

Criteria would be developed to identify desirable uses. These criteria would include uses that: do not detract from site and regional maintenance of wildlife habitat (see policies 1 and 2); assure maintenance of appropriate numbers, health and age structure in wildlife populations; rely principally on natural productivity of wildlife;

maintain aesthetic qualities of the area; provide quality sport; and are consistent with other recreational uses of the area.

6. A policy could be implemented to monitor wildlife populations. This could be done in conjunction with research suggested in policy 5. Criteria could be developed to select specific species whose populations would be monitored on a continuing basis. Such criteria would include species: of high value to man (see policy 3), with vulnerability to direct exploitation because of their habitat and distribution, with dependence on limited, unique or susceptible habitats and whose status would be indicative of trends for a number of non-monitored species.

7. An intensive program could be supported to identify nongame wildlife value and use, and to investigate management tools to maximize nongame values in the coastal zone. Since ecological and aesthetic values of wildlife benefit all residents of the state, broad based financing of programs might be appropriate.

8. A policy could be developed regarding to pest species. Criteria to identify situations where pest problems exist should include: destruction of crops, property or land value; danger to man including possible spread of disease; and interference with human activities.

Such problems would be weighed against the cost and impact of activities needed to alleviate them. Solutions to pest species problems should: retain valuable wildlife at high population levels (see policy 3); maintain balance of natural communities; minimize direct control (killing, trapping) of pest species; and use habitat manipulation and use of buffer strips (policy 8) to control problems when possible.

9. A policy could be implemented to establish buffer strips to protect wildlife populations and control the alteration and destruction of habitats and to reduce pest species problems. The criteria to determine the physical extent and character of the buffer strip are complex. The width, vegetative cover, slope, soil, and drainage pattern will vary depending on the sensitivity and character of the buffered area.

III. PHYSICAL CHARACTERISTICS AND NATURAL FUNCTIONS

Situated on the geologic region known as the coastal plain, the land of the coastal zone has been shaped by climate, ocean currents frequent forest fires, topography, soils and drainage. These sites support diverse vegetative communities which in turn support animal communities. For the purposes of this report these natural communities can be divided into five broad types based on stages of succession, differences in plants, animals present, and problems related to their support of wildlife.

A. Habitat types and characteristics:

Classification of habitat types into various categories is somewhat arbitrary. For the purposes of this report, habitat types have been lumped into the major ecosystem above tidal influence.

1. Dunes and barrier beach uplands
2. Freshwater wetlands
3. Pine barrens
4. Hardwood forests
5. Meadows and fields

1. Dunes and barrier beach uplands

Areas supporting natural dunes and barrier beach upland vegetation exist in a narrow strip mostly limited to

State and Federal owned open space along the Atlantic Ocean coastline. Vegetation present typically includes beach grasses (Ammophila sp.), beach plum, poison ivy, black cherry, and red cedar. Plant and animal communities found there are unique because of the ocean influence. The endangered* osprey often nests in these barrier beaches. A threatened bird species, the Ipswich sparrow, winters along the New Jersey coast exclusively in this habitat. During the fall, large numbers of birds, including several endangered or threatened species use the coastline as a migratory pathway (Table 2). Migrating land birds congregate along the Atlantic coast during fall migration, especially in times of northwest winds (Bull, 1964). Mist netting studies of birds at Island Beach State Park have revealed unexpectedly high numbers of upland birds during fall migration. Many species nesting in northern states and Canada must find feeding and resting places in this habitat while passing through New Jersey to wintering areas as distant as South America.

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*References to endangered or threatened status in this paper are based on the official state list of endangered, threatened, peripheral and undetermined wildlife species as published in the New Jersey Register, April 10, 1975.

2. Freshwater wetlands

Freshwater wetlands in the coastal zone include freshwater marshes, bogs, wooded swamps and aquatic areas. Freshwater marshes are characterized by mucky soil and dominated by such plants as cattail (Typha sp.), wild rice (Zizania sp.) and yellow water lily (Nuphan advena). Bogs are low lying open areas with a seasonal high groundwater level and often underlain by peat. Common bog plants include leatherleaf, laurel, swamp azalea, sphagnum moss, sedges, pitcher plant, sundew, curly grass fern and other plants adapted to acidic water of low fertility. Wooded swamps are low lying forested areas with a seasonally high water table. Dominant plant species include Atlantic white-cedar, pitch pine, red maple, black gum and sweet bay. Aquatic areas are those having permanent fresh water such as streams, rivers, lakes and ponds either natural or man created.

Freshwater wetlands in the coastal zone, support large wildlife populations including many species of limited adaptability. Mammals uniquely adapted to wetlands include the river otter, the threatened southern bog lemming and furbearers such as beaver, muskrats and mink (Table 1.). Numerous birds including 27 hunted species and four species threatened in New Jersey are partially or wholly dependent on freshwater wetlands for their survival (Table 2.). Many reptiles and most amphibians depend on

wetlands part or all of their lives (Tables 3 and 4.). Eight of nine turtles found in the coastal zone including the threatened Eastern tiger salamander and pine barrens tree frog, must have freshwater wetlands for survival. Many wildlife species need specific freshwater wetland sub-types. Marshes support muskrats, breeding waterfowl, wading birds and a variety of songbirds as well as many reptiles and amphibians. Bogs often support uniquely adapted species of plants and animals. Some are rare or endangered such as the pine barrens tree frog. White-tailed deer extensively use wooded swamps, especially those of Atlantic white-cedar which provides nutritious winter food (Little and Somer, 1964 and Kantor, 1976). These wooded swamps are critical to wood ducks, beaver and a variety of birds and mammals. Aquatic areas besides providing habitat for fish supply resting, feeding and migration stops for waterfowl, year round habitat for aquatic turtles, and breeding or year round habitat for amphibians. Gravel pits provide habitat for the endangered Eastern tiger salamander and grey tree frog. Other man created aquatic areas provide freshwater fish with desired habitat and thereby expand human recreational activities.

In general, more valuable wetlands are characterized by diversity of vegetation, presence of aquatic plants and proximity to forests, fields and other types of wetlands.

3. Pine barrens

The pine barrens are an upland sub-climax forest type present on most natural, sandy, arid sites in the New Jersey coastal plain. (The name also applies to a large geographic region in southern New Jersey where this habitat type is dominant.) It is subject to frequent fires which perpetuate pitch pines and discourage hardwoods such as oaks which would otherwise be dominant on these sites. While pitch pine is the dominant tree present the type commonly supports short-leaf pine, black cherry, various oaks and other hardwoods. The "Pine Plains" or "Dwarf Forest" is a unique type within the pine barrens with stunted blackjack oaks, scrub oaks and closed cone (serotinous) race pitch pine. The pine barrens type supports diverse and abundant wildlife. With the exception of aquatic mammals, all mammals found in the coastal zone uplands are found in the Pine Barrens. Numerous birds, amphibians and 29 of Southern New Jersey's 31 reptile species, including the threatened timber rattlesnake are found in the pine barrens.

4. Hardwood forest

Hardwood forests are dry, upland forest areas dominated by a variety of hardwoods but often supporting pitch pine and other conifers. Hardwood forests are common on a variety of sites within the coastal zone, often succeeding pine

dominated forests on sites protected from fire. Composition of hardwood forests vary from site to site with respect to species present and forest age. For this analysis fields overgrown with hardwoods are included in this type. Hardwood forests support the largest number of wildlife species of any habitat type, but this may be due to the extent of distribution and range of sites within this classification. A single site often supports relatively little wildlife. Generally, diverse forests with many species and uneven aged trees or small blocks of differing forest in close proximity to one another provide best opportunities for wildlife. Bottom land forests, forests adjacent to fields and forests interspersed with wetlands are also of high value to wildlife.

5. Meadows and fields

Meadows and fields are open areas of low vegetation present intermittently throughout the coastal zone. Usually present on a temporary basis, their continued existence depends on frequent fires, grazing or man's interference to discourage success of forest species. Fields and meadows receive use by 21 of 39 coastal zone mammals but a relatively small proportion of birds, reptiles and amphibians compared to other major habitat types. However, wildlife species using fields and meadows are often uniquely adapted to these types for their existence or greatly dependent on them during some portion of the year.

B. Natural Functions

While all major habitats can be characterized as to their general value to wildlife and what species they commonly support, specific sites within habitats are often of particular value to wildlife because of behavioral patterns, seasonal or year-round habitat needs. Migration stops, wintering areas and breeding areas are among such sites whose existence is critical for maintaining wildlife. Some wildlife species are colonial in nesting or breeding. In the uplands of the coastal zone, bats, herons, egrets and swallows concentrate their breeding activities in small areas. Freshwater fish, anadromous fish and amphibians often have spawning requirements much more restrictive than those for their individual survival. Specific tributaries or bodies of water may be uniquely valuable for reproduction and therefore critical to maintenance of these species. Migratory birds exploit specific sites that are strategically located and fulfill their habitat requirements. Waterfowl concentrate on certain marshes, lakes, or reservoirs while largely bypassing others. Shorebirds and geese often stop and feed in specific agricultural fields and meadows along migration routes. Upland birds, such as a woodcock, tend to congregate in areas such as Cape May where their path of migration is interrupted by large bodies of water. Winter brings flocking and herding of many species with high use of areas of abundant or high quality food or cover. Quality

of these habitats can directly determine species abundance and reproductive success at other seasons. Deer congregate in "yarding areas" having desirable cover. Maintenance through this time of year is critical to health and productivity of the herd. Some species hibernate in areas of specific habitat. Bats gather in caves and buildings; snakes may winter in rocky areas, sometimes in much greater densities than during their summer dispersal.

C. Values of Wildlife Resources

The values of the wildlife resource can be broken down into consumptive use (hunting, fishing, trapping) non-consumptive use (bird watching, photography, etc.) and ecological value. Sportsmen spend over $3 million yearly for licenses to fish and hunt in New Jersey.* A study completed in 1965 determined that hunters contributed $31.4 million to the economy of New Jersey yearly while enjoying 2.5 million man-days of recreation in pursuit of their sport (N.J. Division of Fish & Game, 1965). Given inflation and an increase in hunters since 1965, the present value may approach $60 million annually. Add

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*All figures are based on the annual report of the New Jersey Division of Fish, Game and Shellfisheries covering the 1974-1975 hunting season and fiscal year unless otherwise noted.

to this the $3.5 million trapping industry and the amounts spent on freshwater fishing and one can appreciate the great value of consumptive wildlife resources to the economy of New Jersey. Many of the important game species in New Jersey occur commonly in the uplands of the coastal zone (Table 5). Approximately 50% of deer and small game hunting in New Jersey occurs on the coastal plain with 75% of the State's 44,000 waterfowl hunters also concentrating their efforts there.

Non-game wildlife interest has increased dramatically in recent years. While the great aesthetic value of wildlife cannot be put in monitary terms, DeGraff and Payne (1975) conservatively estimated $500 million spent in the U.S. annually on non-game bird interests alone. Our primary concern are species now endangered, rare or unique. Protection of endangered species, their habitats and remedy of problems causing their decline is essential if these species are to be retained as part of New Jersey's wildlife resource. Dues paid by members of the Audubon Society have doubled in the past four years. This trend of increased non-game wildlife interest and use is likely to continue.

Ecological values represented by the wildlife resource are complex and difficult to quantify or put monetary terms. Suffice to say that all other values of wildlife and maintenance of quality human life are dependent on some

degree of ecological stability. Wildlife represents an intricate and irreplaceable part in the ecology of the coastal zone. The elimination or disruption of any one species may cause widespread effects to the environment and man.

IV. ANALYSIS

Three crucial issues need examination: the alteration and destruction of wildlife habitats by human activities, man's use and misuse of the wildlife resources, and incompatability of some species with man and his land uses.

Wildlife species depend on the habitat to supply their needs for food, cover, and water. How well sites fulfill the unique needs of species determines their distribution and abundance. Slight differences in habitat may mean the difference between abundance and absence of a species in an area. Similarly, slight changes in a habitat may cause great changes in numbers and diversity of the wildlife community found there. Wildlife populations tend to increase toward an area's carrying capacity (the maximum number the habitat will support). Therefore, wildlife driven out of developing areas does not find room in the surrounding occupied habitat and usually represents a loss to the State's wildlife resource.

A. Human Activities

Major land uses by man, forestry, agriculture and urbanization, vary in their general compatibility with desirable wildlife communities. Forestry simulates the natural pattern of forest destruction, succession and maturation caused by fire, windstorm or flood. Diverse habitat with mature forest, young forest, and open land can be maintained

by sustained yield forestry. Such habitat supports higher numbers of deer, upland game species and non-game wildlife than climax forests. Forestry practices, particularly harvesting of trees, must however be regulated for forestry to be highly compatible with wildlife values (Clawson, 1975). Unregulated forestry can produce extensive clear-cuts which are of little short-term value to most wildlife species. Clearcutting may cause erosion of soil which lessens future site productivity and alters adjacent wetlands. Selective harvesting and forest management practices that limit tree species diversity are usually unfavorable to wildlife. Removal of dead and hollow trees which are valuable as dens and nesting sites, and reduction in abundance of non-marketable trees which may be of great value to wildlife also degrade wildlife habitat. Long-term effects of forestry are not well known but site degradation resulting from a series of harvests may reduce a forest's wildlife supportive capacity. Forestry in the coastal zone is generally not intensive with the exception of cutting of Atlantic white-cedar. Cutting of cedar stands followed by heavy deer browsing may prevent vegetative regeneration of these trees thereby eliminating such stands.

1. Forest fire suppression

Fire suppression for forestry and other human interests has varied effects on wildlife. Though wildfires may kill

individual animals, their major effect is to change the habitat. Wildlife concentrations often increase greatly in an area following a fire. The Pine Barrens ecosystem has been perpetuated by frequent fires. The dominant pitch pines and oaks are adapted for rapid regeneration following fires. Suppression of fire in the Pine Barrens over long periods will alter the unique community found there. The New Jersey Division of Fish, Game and Shellfisheries is currently conducting studies on the effects of controlled burning of woodlands. Not enough is presently known about frequency and intensity of fire needed to maintain the pine barrens type to ensure its ecological balance in the future.

2. Agriculture

While agricultural fields provide habitat somewhat similar to natural fields and meadows, seasonal cultivation and harvest practices detract from their value to wildlife. Year round wildlife residence usually depends on adjacent desirable habitat. Intense agricultural use of land leaves little forested or overgrown habitat, causes problems of erosion, pesticide pollution and eutrophication of adjacent waters, and greatly decreases the acceptability of land to wildlife. Retention of overgrown edges, woodlots and marshes combined with crop plantings that provide food and cover can increase on-site value of agricultural land to wildlife. Edges or ecotones between

two habitat types (field and forest, for example) usually support higher numbers of animals and greater species diversity than uniform areas of one habitat type. Such agricultural practices are seldom justifiable to farmers, however, unless they place a high value on the wildlife resource or are compensated for wildlife maintenance efforts, through hunting club leasing.

3. Urbanization

Urbanization is usually accompanied by complete elimination of much natural habitat and degradation of that remaining. This along with the presence of humans and domestic animals makes urbanized areas unacceptable for most wildlife, resulting in loss of wildlife diversity as well as numbers. Urbanization need not mean an elimination of all wildlife in most cases. Suburban areas characterized by ornamental shrubs, shade trees and lawns have a vegetative structure and diversity which can support a number of bird species (DeGraff 1975). Some adaptable species such as the chipping sparrow, starling, mockingbird and house sparrow increase in abundance as suburban communities develop. High density urban areas that support few bird species apparently lack adequate vegetation. Urban parks and cemeteries support high numbers of birds indicating that given suitable vegetation some desirable wildlife can survive in the most densely populated areas. Most wildlife other than birds fare

poorly in urban and suburban areas due to their more limited mobility. To establish and maintain populations of mammals, reptiles and amphibians in these areas interconnected complexes of desirable habitat must be preserved. Such pathways are of greatest value when along waterways which serve as natural travel routes for wildlife.

B. Human and Wildlife Interactions

Of the five major upland habitat described in this chapter, dunes and barrier beaches have been most heavily exploited by man. Only about 35% of original dune and barrier beach vegetation remains along ocean beaches, mostly in areas set aside for recreation and preservation. Past development has been intensive, leaving little or no native vegetation or natural wildlife habitat in areas not owned by the State or Federal government. Resident wildlife using this habitat must rely on isolated tracts, hindering the maintenance and dispersal of species of low mobility. Migratory species are usually mobile enough to seek out suitable habitat for resting and feeding given that significant areas of desirable habitat are well distributed along the coast.

Wetland, with its great wildlife value, combines man's desire for intense use with vulnerability to degradation. Early New Jersey towns were established along waterways where transportation was easiest. Industrial needs for

water dictated that factories be established in similar locations. More recently, recreational facilities and housing have been developed on and near these aesthetically desirable wetland habitats. Man's long and intense use of wetlands has created a history of habitat alteration. Between the years 1953 and 1973, 23.5% (61,678 acres) of New Jersey tidal marshes were destroyed through filling, dredging, and diking (Ferrigno et al, 1973). Similar destruction has taken place in freshwater wetlands. Direct dumping of industrial wastes and sewage along with indirect pollution in the form of urban and agricultural runoff has caused innumerable problems to wildlife. Pesticides, heavy metals, and other toxins enter aquatic food chains and concentrate in dominant predators such as gamefish and fish eating birds causing death or inhibiting their reproduction. Ospreys, whose numbers have been greatly reduced by pesticides, once had their greatest abundance along the New Jersey and Long Island coast. Oil spills have killed numerous waterfowl in New Jersey. Heated water discharges, siltation, and fertilizer runoff cause eutrophication of wetlands changing their acceptability to many species. Fish vary in their ability to adapt to man's manipulation and pollution of wetlands, but productivity of important freshwater gamefish such as trout, bass and pickerel ultimately suffers. Acidity changes from various pollutants, even when slight, may inhibit reproduction in a range of fish and amphibians.

While the Pine Barrens are less vulnerable to pollution degradation than the wetlands within them, unregulated development could reduce their wildlife supportive capacity. Presently this unique habitat is little effected by man. Breaking up of this contiguous area would doubtlessly have some effects on its ecological stability. Development in the Pine Barrens may also adversely effect the ground water reservoir underlying it and the freshwater systems running through it.

Hardwood forests, present extensively on the coastal zone uplands are somewhat resistant to degradation. While disruption of sites alter their capacity to support wildlife, regional effects of limited hardwood development would be slight. Forested lowlands (one step removed from wooded swamps) are probably the most vulnerable sub-type of hardwood forest and support the most wildlife. Development or alteration of these areas or their water table greatly effect the ecology of these areas.

Fields and meadows are natural habitat types once more abundant and now decreasing with fire suppression. Evidence of the previous extent of such types in the coastal zone uplands includes the recorded abundance of the heath hen (now extinct) in southern New Jersey (Bull 1964). This subspecies of the prairie chicken was uniquely adapted to these open habitats. Bull (1964) lists 13 bird species undergoing population decreases in the New York

City area; of these six species, (upland plover, bobolink, meadowlark, grasshopper sparrow, Henslow's sparrow and vesper sparrow) are attributed to reduction of fields and meadows. While man creates fields through agriculture, clearing trees and other activities these fields cannot support the wildlife community previously found in naturally maintained fields and meadows.

Sites with high seasonal or year round use by wildlife present a different problem than posed by general destruction of habitat types. These sites: critical breeding, migration and wintering locations often depend on their unique physical make-up and vegetative communities present to maintain their value to wildlife. Slight alteration may negate their present high value. Dependence on these sites by large numbers or variety of wildlife amplifies the threat of direct exploitation or site degradation. Sites supporting high numbers of waterfowl may increase the temptation to engage in illegal shooting. Nesting bird colonies are often noisy and obvious leading to widespread knowledge of their location and threaten to their existence. Deer wintering areas represent a small portion of their overall yearly range, elimination of a relatively small but critical site may adversely effect deer populations for miles around.

Destruction of a small pond which is uniquely valuable for breeding salamanders could likewise eliminate their presence in surrounding uplands. A major problem in dealing with valuable sites such as these is that their value may not be apparent during all seasons of the year. Migration stops of importance could not be determined in July. No comprehensive compilation or mapping of valuable wildlife sites exists for reference when one is attempting to determine wildlife value of specific sites or areas.

Historically, hunting, trapping and fishing have had great and lasting effects on the wildlife resources of North America. Today, under careful regulation, these activities have greatly reduced impacts. Harvest data is carefully compiled (Table 6) and used as a basis for future regulation and management of the resource. Maintaining wildlife populations along with large and expanding human populations magnifies problems of illegal hunting, collecting and harrassment of wildlife. Though laws generally exist to protect wild species, enforcement capability is limited even with recent additions in personnel.

Increased numbers of hunters and fishermen combined with loss of wildlife habitat decrease in areas open for public use, have lessened the quality of sport in New Jersey. Maintenance of open lands is difficult given landowner

attitudes and continued population growth. Landowners frequently consider hunters and fishermen a danger to their lands and property and a nuisance in terms of discarded trash. Towns increasingly have passed laws against discharging firearms, thereby outlawing hunting. Even with attempts to improve sportsmen-landowner relationships it seems unlikely that this trend will soon be reversed. Rate at which land is lost to New Jersey sportsmen is lessened by continual acquisition of hunting and fishing management areas by the state.

Presently, wildlife management on hunted and fished areas is a way of maintaining wildlife numbers available to sportsmen. Such effort is concentrated on state owned lands whose future is more certain. Habitat management on these areas coupled with stocking of game, produces more hunting and fishing opportunities. While stocking is generally supported by sportsmen whose money funds management of game species, biological considerations and maintenance of quality sport have recently inspired alternate management programs. Decreased consumption in the form of "fly-fishing only" and "no kill" fishing areas, plus more reliance on fish naturally produced is designed to increase quality of sport while maintaining game fish numbers. The Division of Fish, Game and Shellfisheries is presently conducting a study to determine how trout can best be managed in various waters within the state.

In the coastal zone this could suggest a shift away from "put and take" fishing for stocked trout, with increased reliance on pickerel, largemouth bass and other native warm-water species. Hunting pressure is presently concentrated on some species while other game is less sought (Table 7). Alteration of bag limits, open seasons, and public relations efforts aimed at hunters influence where and what species they hunt thereby controlling hunter distribution and pressure on game. Recently instituted control of hunter numbers on some state lands may alleviate problems of overcrowding, protect game resources from overexploitation, and thereby improve the quality of sport.

Refuges, originally created for wildlife protection have received increased human use. Control of visitors has become the greatest problem at many federal wildlife refuges. Maximum use of non-game wildlife by humans is often inconsistent with highest wildlife productivity. Likewise, inaccessable refuges undeveloped for recreational use may be highly productive of wildlife but lesser value in terms of human use. Wildlife refuges and other wildlife containing areas are most valuable for human use when located in or near population centers where opportunities to view wildlife are otherwise limited. Such facilities keep city and suburban residents in touch with the natural world, maintaining quality of urban life and assuring that their appreciation and votes on environmental issues are based on some knowledge of natural systems.

Maintenance of wildlife resources in a human dominated state causes some direct problems. Many of the nuisance wildlife or wildlife damage complaints received by the Division of Fish, Game and Shellfisheries (639 complaints in fiscal 1975 can be easily handled). Leaving the animals alone, trapping and removal of problem individuals and altering habitat to discourage use by wildlife can solve many of the problems. Other wildlife complaints and problems of wider scope are less easily handled. Deer are capable of significant destruction of crops, ornamental plants and even their natural forest habitat. Locally high deer populations can be reduced by increased legal hunting or controlled by fencing and use of repellants, for which the Division of Fish, Game and Shellfisheries spent $13,000 in the fiscal year 1975. Crop destruction by blackbirds and other species, flooding of roads and other property by beaver, birds on airport runways, auto-deer collisions, pest species in or near human habitation, potential for spread of disease by wildlife, and other problems of wildlife "out of place" in relation to man's world, continue to exist because control measures are often costly or lacking. Better understanding of wildlife needs and behavior is often the first step in solving problems of conflict between wildlife and man.

APPENDIX A

REGIONAL REPORTS

1. Hudson River Region (Hudson, Union, Essex and Bergen Counties)

The Hudson River Region has the highest population (almost 1/2 the population in the state), most intense development and least wildlife habitat of any region.

General Characteristics

This region is largely composed of residential, commercial and industrial development with little wildlife habitat, especially in areas adjacent to the Hudson River. Natural habitats are small in size and scattered; many are small parks and sanctuaries. Wetlands of good quality are scarce with most river systems suffering from pollution. Wildlife present in this region are species adapted to environments effected by man.

Analysis

Species variety and wildlife numbers are lower in this area than any other region. Migratory birds passing through this area contribute significantly to species diversity. Hunting and fishing opportunities in the region are limited. Hunting is effectively prohibited in many towns due to local ordinances. Fishing is limited by poor water quality. Remaining habitat has value to nongame species especially in support of resident and migratory songbirds.

One exception is the district managed by the Hackensack Meadowlands Development Commission.

2. North Shore Region (Monmouth and Middlesex Counties)

The North Shore Region has the most extensive development by man of any region besides the Hudson River Region. Most remaining wildlife habitat exists inland, highest development having taken place along the coast.

General Characteristics

Residential, commercial, industrial (Middlesex) and agricultural (inland Monmouth) land uses have greatly restricted the extent of valuable upland wildlife habitat. While some forest and field habitat remains inland, freshwater wetland and barrier beach habitat of high quality is limited. Intense human use has created pollution problems in many waterways. Wildlife variety and numbers are rather low except in inland undeveloped areas.

Analysis

Though man dominates this area, some upland wildlife habitats remain. Hunting and fishing opportunities exist although largely limited to public lands. Recreational demand related to wildlife is high in this region. Continued development in remaining habitats could eliminate this area's value in supporting diverse and numerous wildlife. Remaining natural upland habitats near the coast are particularly valuable to migrating birds in fall.

3. Central Shore Region (Ocean County)

Though not as highly developed as the North Shore Region, Ocean County has experienced the highest growth rate of any part of the state. Extensive upland habitat has been developed in recent years but much remains natural.

General Characteristics

This region contains a diversity of upland wildlife habitats. Barrier beaches are largely developed except for Island Beach State Park. Estuaries and salt marshes not specifically dealt with in this paper are extensive and valuable. Pine barrens comprise virtually all of the uplands. Valuable freshwater wetlands including the state's most extensive white-cedar swamps are also found here. Maintaining water quality is a problem in some areas. In general, wildlife values are high except in areas of local intense development.

Analysis

Wildlife is abundant in the Central Shore Region, though intense development must be controlled to assure future habitat value. Pine barrens and freshwater wetlands support a variety of wildlife including some unique or endangered species. Inland areas of forest and wetlands interspersed with some agricultural fields provide suitable areas for hunting and fishing. Residential development of the area has increased the demand for wildlife related recreation. Remaining coastal habitats are valuable for game and nongame bird migrants. Ocean County is used by the highest number of duck, geese and rail hunters of any county in the state.

4. South Shore (Atlantic and Cape May Counties)

The South Shore provides a contrast with heavy development along much of the immediate Atlantic coastline but little development, aside from agriculture, inland.

General Characteristics

The South Shore Region has some undeveloped barrier beach areas, extensive salt marshes and estuaries, upland forest (the southern extent of the Pine Barrens), and desirable freshwater wetlands. Cedar swamps are widely distributed. The fact that one third of beaver trapped in New Jersey in recent years have come from this region gives an indication of its freshwater wetland quality. This area may support the most diverse wildlife population of any coastal zone region.

Analysis

Of the three regions bordering the Atlantic Ocean, this region has had the least development, however, valuable coastal habitat has been and continues to be lost to development. Generally inland habitats seem stable at this time but because of their high value, unregulated development in the future must be prevented. Hunting and fishing opportunities are high in this region. Nongame species are varied and abundant. Cape May is an area where large numbers of migrating birds linger during fall migration, waiting for suitable weather before flying across Delaware Bay. For this reason the region provides some of the best birdwatching opportunities in the State.

5. Delaware Bay Region (Cumberland and Salem Counties)

This region is the most sparsely settled. Agricultural uses dominate inland areas.

General Characteristics

Located on the Delaware Bay shore this area supports extensive salt marshes and in upland areas has extensive natural forests. Though most lands are little effected by man's presence, wildlife variety and numbers do not surpass those found on the outer (Atlantic Ocean) coast.

Analysis

This area has had least alteration by man of any region. Hunting and fishing opportunities abound. Pressure for development by man is not anticipated in the near future. Present agricultural uses cause local problems by limiting natural habitat and diking adjacent wetlands.

6. Delaware River Region

This region has some of the most developed industrial, commercial and residential areas in the state as well as some of the most valuable farmland.

General Characteristics

This area has highly industrialized areas adjacent to the Delaware River. Further east are prime agricultural lands. Despite the intense use of this region by man, much natural habitat and high numbers of wildlife are present. Water and wetland quality is low in more intensely used areas.

Analysis

This region reflects a variety of the problems wildlife face in the state. Developed areas with little wildlife habitat, areas with intense agriculture and its related problems (and benefits) to wildlife and high recreational demand for the wildlife resource exist in this area. Regulation of future development and control of agricultural impacts seem needed given an anticipated increase in human domination.

APPENDIX B

TABLES

Table 1: Habitat preference of mammals regularly occurring in the uplands of the New Jersey coastal zone.

Name	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Oppossum					
Didelphis virginiana	X		X	X	X
Eastern mole					
Scalopus aguaticus			X	X	X
Starnosed mole					
Condylura cristata		X			
Masked shrew					
Sorex cinereus	X		X	X	
Least shrew					
Cryptotis parva			X	X	X
Shorttailed shrew					
Blarina brevicauda			X	X	X
Little brown bat					
Myotis lucifugus	X	X	X	X	X
Keen's myotis (Threatened)					
Myotis keenii			X	X	
Eastern pipistrell					
Pipistrellus subflavus	X	X	X	X	X

Red bat					
Lasiurus borealis			X	X	
Hoary bat					
Lasiurus cinereus	X	X	X	X	X
Silverhaired bat					
Lasionycteris notcvagans	X	X	X	X	X
Big brown bat					
Eptesicus fuscus	X	X	X	X	X
Eastern cottontail .					
Sylvilagus floridanus	X		X	X	X
Grey squirrel					
Sciurus carolinensis			X	X	
Chipmunk					
Tamias striatus			X	X	
Red squirrel					
Tamiasciurus hudsonicus			X	X	
Flying squirrel					
Glancomys volans			X	X	
Beaver					
Castor canadensis		X			
Woodchuck					
Marmota monax			X	X	X
Meadow jumping mouse					
Zapus hudsonius	X		X	X	X
Whitefooted mouse					
Peromyscus leucopus	X		X	X	

Table 1: Mammals (continued)

Name	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Muskrat					
Ondatra zibethicus		X			
Southern bog lemming(Threat.)					
Synaptomys cooperi		X			
Meadow vole					
Microtus pennsylvanicus	X		X	X	X
Pine vole					
Pitymys pinetorum			X	X	X
Redbacked vole					
Clethrionomys gapperi			X	X	
Rice rat					
Oryzomys palustris		X			
Norway rat					
Rattus norvegicus		X	X	X	X
Black rat					
Rattus rattus		X	X	X	X
House mouse					
Mus musculus	X		X	X	X
Raccoon					
Procyon lotor	X	X	X	X	X
Longtailed weasel					
Mustela frenata		X	X	X	

Mink						
Mustela vison			X			
River otter						
Lutra canadensis			X			
Striped skunk						
Mephitis mephitis				X	X	X
Red fox						
Vulpes fulva				X	X	X
Grey fox						
Urocyon cinereoargenteus				X	X	
Whitetailed deer						
Odocoileus virginiana		X		X	X	X
Total of coastal zone upland mammals	39	14	13	30	30	21

source: adapted from Applegate (1974).

Table 2: Habitat preference of birds regularly occurring in the uplands of the New Jersey coastal zone.

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Common loon					
Gavia immer		X			
Red-throated loon					
Gavia stellata					
Horned grebe					
Podiceps auritus		X			
Pied-billed grebe					
Podilymbus podiceps		X			
Double-crested cormorant					
Phalacrocorax auritus		X			
Great blue heron					
Ardea herodias	X	X			
Cattle egret					
Bubulcus ibis	X	X			X
Common egret					
Casmerodius albus	X	X			
Snowy egret					
Leucophoyx thula	X	X			

Little blue heron				
Florida caerulea	X	X		
Green heron				
Butorides virescens	X	X		
Black-crowned night heron				
Nycticorax nycticorax	X	X		
Yellow-crowned night heron				
Nyctanassa violacea (Threat.)		X		
American bittern				
Botaurus lentiginosus		X		
Least bittern (Threatened)				
Ixobrychus exilis		X		
Glossy ibis				
Plegadis falcinellus	X	X		
Mute swan				
Cygnus olor		X		
Canada goose				
Branta canadensis		X		X
Snow goose				
Chen hyperborea				X
Mallard				
Anas platyrhynchos		X		X
Black duck				
Anas rubripes		X		
Gadwall				
Anas strepera		X		

Table 2: Birds (continued)

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Pintail					
Anas acuta		X			
Green-winged teal					
Anas carolinensis		X			
Blue-winged teal					
Anas discors		X			
American widgeon					
Mareca americana		X			
Shoveller					
Spatula clypeata		X			
Wood duck					
Aix sponsa		X		X	
Redhead					
Aythya americana		X			
Ring-necked duck					
Aythya collaris		X			
Canvasback					
Aythya valisineria		X			
Greater scaup					
Aythya marila		X			
Lesser scaup					
Aythya affinis		X			

American goldeneye					
Bucephala clangula		X			
Bufflehead					
Bucephala albeola		X			
Ruddy duck					
Oxyura jamaicensis		X			
Hooded merganser					
Lophodytes cucullatus		X			
American merganser					
Mergus merganser		X			
Red-breasted merganser					
Mergus serrator		X			
Turkey vulture					
Cathartes aura	X		X	X	X
Sharp-shinned hawk (Threat.)					
Accipiter striatus	X		X	X	
Cooper's hawk (Endangered)					
Accipiter cooperii			X	X	
Red-tailed hawk					
Buteo jamaicensis			X	X	
Red-shouldered hawk (Threat.)					
Buteo lineatus			X	X	
Broad-winged hawk					
Buteo platypterus			X	X	

Table 2: Birds (continued)

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Marsh hawk (Threatened)					
Circus cyaneus	X				X
Osprey (Endangered)					
Pandion haliaetus	X	X			
Peregrine falcon (Endangered)					
Falco peregrinus	X				
Pigeon hawk (Threatened)					
Falco columbarius	X				
Sparrow hawk					
Falco sparverius	X		X	X	X
Ruffed grouse					
Bonasa umbellus			X	X	
Bobwhite					
Colinus virginianus	X		X	X	X
Ring-necked Pheasant					
Phasianus colchicus	X		X	X	X
King rail (Threatened)					
Rallus elegans		X			
Sora					
Porzana carolina		X			

Yellow rail			
Coturnicops noveboracensis	X		
Common gallinule			
Galinula chloropus	X		
American coot			
Fulica americana	X		
Killdeer			
Charadrius vociferus	X		X
Golden plover			
Pluvialis dominica			X
Black-bellied plover			
Squatarola squatarola			X
American woodcock			
Philohela minor	X	X	
Common snipe			
Capella gallinage	X		
Upland plover (Threatened)			
Bartramia longicauda			X
Spotted sandpiper			
Actitis macularia	X		
Solitary sandpiper			
Tringa solitaria	X		
Greater yellowlegs			
totanus melanoleucus	X		

Table 2: Birds (continued)

Bird	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Lesser yellowlegs					
Totanus flavipes		X			
Pectoral sandpiper					
Erolia melanotos		X			X
Least sandpiper					
Erolia minutilla		X			
Herring gull					
Larus argentatus		X			X
Ring-billed gull					
Larus delawarensis		X			X
Rock dove					
Columba livia	X				X
Mourning dove					
Zenaidura macroura	X		X	X	X
Yellow-billed cuckoo					
Coccyzuz americanus			X	X	
Black-billed cuckoo					
Coccyzuz erythropthalmus			X	X	
Barn owl					
Tyto alba				X	X

Screech owl					
Otus asio			X	X	X
Great horned owl					
Bubo virginianus	X		X	X	X
Barred owl (Threatened)					
Strix varia		X		X	
Long-eared owl					
Asio otus	X		X	X	
Short-eared owl (Threat.)					
Asio flammeus	X				
Saw-wheat owl					
Aegolius aacadicus	X		X	X	
Whip-poor-will					
Caprimulgus vociferus			X	X	
Common nighthawk					
Chordeiles minor			X	X	X
Chimney swift					
Chaetura pelagica			X	X	X
Ruby-throated hummingbird					
Archilochus colubris	X		X	X	
Belted kingfisher					
Megaceryle alcyon		X			

Table 2: Birds (continued)

Bird	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Yellow-shafted flicker					
Colaptes auratus	X		X	X	X
Pileated Woodpecker					
Dryocopus pileatus				X	
Red-bellied woodpecker					
Centurus carolinus	X		X	X	
Red-headed woodpecker (Threat.)					
Melanerpes erythrocephalus	X			X	
Yellow-bellied sapsucker					
Sphyrapicus varius	X		X	X	
Hairy woodpecker					
Dendrocopos villosus	X		X	X	
Downy woodpecker					
Dendrocopos pubescens	X		X	X	
Eastern kingbird					
Tyrannus tyrannua	X		X	X	
Great crested flycatcher					
Myiachus crinitus	X		X	X	
Eastern phoebe					
Sayornis phoebe	X		X	X	
Yellow-bellied flycatcher					
Empidonax flaviventris	X		X	X	

Acadian flycatcher					
Empidonax virescens	X		X		
Trail's flycatcher					
Empidonax traillii	X	X	X	X	
Least flycatcher					
Empidonax minimus	X		X	X	
Eastern wood pewee					
Contopus virens	X		X	X	
Olive-sided flycatcher					
Nutallornis borealis	X		X	X	
Horned lark					
Eremophila alpestris	X				X
Tree swallow					
Iridoprocne bicolor	X	X	X	X	X
Bank swallow					
Riparia riparia	X	X	X	X	X
Rough-winged swallow					
Stelgidopteryx ruficollis		X	X	X	X
Barn swallow					
Hirundo rustica	X	X	X	X	X
Cliff swallow					
Petrochelidon pyrrhonota	X	X	X		X
Purple martin					
Progne subis	X	X	X	X	X

Table 2: Birds (continued)

Name	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Blue jay					
Cyanocitta cristata	X		X	X	
Common crow					
Corvus brachyrhynchos			X	X	X
Fish crow					
Corvus ossifragus	X		X	X	X
Black-capped chickadee					
Parus atricapillus	X		X	X	
Carolina chickadee					
Parus carolinensis	X		X	X	
Tufted titmouse					
Parus bicolor	X		X	X	
White-breaster nuthatch					
Sitta carolinensis	X		X	X	
Red-breasted nuthatch					
Sitta canadensis	X		X	X	
Brown creeper					
Cethia familiaris	X		X	X	
House wren					
Torglodytes aedon	X		X	X	
Winter wren					
Troglodytes troglodytes	X		X	X	

Bewick's wren					
Thryomanes bewickii					
Carolina wren					
Thryomanes ludovicianus	X		X	X	
Long-billed marsh wren					
Telmatodytes palustris	X	X			
Short-billed marsh wren (Threat.)					
Cistothorus platensis	X	X			
Mockingbird					
Mimus polyglottos	X		X	X	
Catbird					
Dumetella carolinensis	X		X	X	
Brown thrasher					
Toxostoma rufum	X		X	X	
Robin					
Turdus migratorius	X		X	X	X
Wood thrush					
Hylocichla mustelina	X		X	X	
Hermit thrush					
Hylocichla guttata	X		X	X	
Swainson's thrush					
Hylocichla ustulata	X		X	X	
Grey-cheeked thrush					
Hylocichla minima	X		X	X	

Table 2: Birds (continued)

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Veery					
Hylocichla fuscescens	X		X	X	
Eastern bluebird					
Sialia sialia	X			X	X
Blue-grey gnatcatcher					
Polioptila melanura	X		X	X	
Ruby-crowned kinglet					
Regulus calendula	X		X	X	
Golden-crowned kinglet					
Regulus satrapa	X		X	X	
Water pipit					
Anthus spinoletta		X			
Cedar waxwing					
Bombycilla cedrorum	X		X	X	
Loggerhead shrike					
Lanius ludovicianus	X			X	
Starling					
Sturnus vulgaris	X		X	X	X
White-eyed vireo					
Vireo griseus	X		X	X	
Solitary vireo					
Vireo solitarius	X		X	X	

Red-eyed vireo			
Vireo olivaceus	X	X	X
Warbling vireo			
Vireo gilvus	X		X
Black and white warbler			
Mniotilta varia	X	X	X
Prothonotary warbler			
Protonotaria citrea	X	X	X
Worm-eating warbler			
Helmitheros vermivorus	X	X	X
Golden-winged warbler			
Vermivora chrysoptera	X		X
Blue-winged warbler			
Vermovora pinus	X	X	X
Vermovora pinus	X	X	X
Tennessee warbler			
Vermivora peregrina	X	X	X
Nashville warbler			
Vermivora ruficapilla	X	X	X
Parula warbler			
Parula americana	X	X	X
Yellow warbler			
Dendroica petechia	X	X	X
Magnolia warbler			
Dendroica magnolia	X	X	X

Table 2: Birds (continued)

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Cape May warbler					
Dendroica tigrina			X	X	
Black-throated blue warbler					
Dendroica caerulescens			X	X	
Myrtle warbler					
Dendroica coronata	X		X	X	
Black-throated green warbler					
Dendroica virens			X	X	
Blackburnian warbler					
Dendroica fusca			X	X	
Chestnut-sided warbler					
Dendroica pennsylvanica	X		X	X	
Bay-breasted warbler					
Dendroica castanea	X		X	X	
Blackpoll					
Dendroica striata	X		X	X	
Pine warbler					
Dendroica pinus	X		X	X	
Prairie warbler					
Dendroica discolor	X		X	X	
Palm warbler					
Dendroica palmarum	X		X	X	

Ovenbird					
Seiurus aurocapillus	X		X	X	
Northern water thrush					
Seiurus noveboracensis		X			
Louisiana waterthrush					
Seiurus motacilla		X			
Kentucky warbler					
Oporonis formosus	X		X	X	
Connecticut warbler					
Oporonis agillis	X		X	X	
Yellowthroat					
Geothylpis trichas	X		X	X	
Yellow-breasted chat					
Icteria virens	X			X	
Hooded warbler					
Wilsonia citrina	X		X	X	
Wilson's warbler					
Wilsonia pusilla	X				
Canada warbler					
Wilsonia canadensis	X		X	X	
American redstart					
Setophaga ruticilla	X		X	X	
House sparrow					
Passer domesticus					X

Table 2: Birds (continued)

Birds	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Bobolink					
Dolichonyx oryzivorus	X		X	X	X
Eastern meadowlark					
Sturnella magna	X			X	X
Red-winged blackbird					
Agelaius phoeniceus	X	X			X
Orchard oriole					
Icterus spurius	X		X	X	
Baltimore oriole					
Icterus galbula	X		X	X	
Bullock's oriole					
Icterus bullockii					
Rusty blackbird					
Euphagus carolinus	X	X	X	X	
Brewer's blackbird					
Euphagus cyanocephalus					
Common grackle					
Quiscalus quiscula	X		X	X	X
Brown-headed cowbird					
Molothrus ater	X		X	X	X
Scarlet tanager					
Piranga olivacea	X		X	X	

Cardinal				
Richmondena cardinalis	X	X	X	
Rose-breasted grosbeak				
Pheucticus ludovicianus	X	X	X	
Indigo bunting				
Passerina amoena	X	X	X	
Evening grosbeak				
Herperiphona vespertina	X	X	X	
Purple finch				
Carpodacus purpureus	X	X	X	
House finch				
Carpodacus mexicanus	X	X	X	
Common redpoll				
Acanthis flammea	X	X	X	
Pine siskin				
Spinus pinus		X	X	
American goldfinch				
Spinus tristis	X	X	X	X
Red crossbill				
Loxia curvirostra		X	X	
Rufous-sided towhee				
Pipilo erthrophthalmus	X	X	X	

Table 2: Birds (continued)

Bird	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Ipswich sparrow (Threatened)					
Passerculus princeps	X				
Savannah sparrow					
Passerculus sandwichensis	X			X	X
Grasshopper sparrow (Threat.)					
Ammodramus savannarum	X			X	X
Henslow's sparrow					
Passerherbulus henslowii	X			X	X
Sharp-tailed sparrow					
Ammospiza caudacuta	X				
Seaside sparrow					
Ammospiza maritima	X				
Vesper sparrow (Threatened)					
Pooecets gramineus				X	X
Slate-colored junco					
Junco hyemalis	X		X	X	X
Tree sparrow					
Spizella arborea			X	X	
Chipping sparrow					
Spizella passerina			X	X	X
Field sparrow					
Spizella pusilla			X	X	X

White-crowned sparrow						
Zonotrichia leucophrys		X		X	X	
White-throated sparrow						
Zonotrichia albicollis				X	X	
Fox sparrow						
Passerella iliaca		X		X	X	
Swamp sparrow						
Melospiza georgiana		X	X	X	X	
Song sparrow						
Melospiza melodia		X		X	X	
Snow bunting						
Plectrophenax nivalis		X				X
Total coastal zone upland birds	218	135	71	124	137	51

source: Applegate (1974) Bull (1964)

Table 3: Habitat preference of reptiles regularly occurring in the uplands of the New Jersey coastal zone.

Name	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Common snapping turtle					
Chelydra serpentina	X	X	X	X	
Stinkpot					
Sternotherus odoratus	X	X	X	X	
Eastern mud turtle					
Kinosternon subrubrum		X	X	X	
Spotted turtle					
Clemmys guttata		X	X	X	
Bog turtle (Endangered)					
Clemmys muhlenbergi		X	X	X	
Eastern box turtle					
Terrapene carolina	X		X	X	X
Eastern Painted turtle					
Chrysemys picta		X	X	X	
Red-bellied turtle					
Pseudemys rubriventris		X	X		
Eastern spiny softshell					
Trionyx spinifer		X	X		
Northern fence lizard					
Sceloporus undulatus			X		

Ground skink (Peripheral)				
Scincello laterale		X		
Five-lined skink				
Eumeces fasciatus		X	X	
Northern water snake				
Natrix sipedon	X	X	X	X
Queen snake				
Natrix septemvittata	X			
Northern brown snake				
Storeria dekayi		X	X	X
Northern red-bellied snake				
Storeria occipitomaculata		X	X	
Eastern garter snake				
Thamnophis sirtalis	X	X	X	X
Eastern ribbon snake				
Thamnophis sauritus	X	X	X	X
Eastern earth snake (Threat.)				
Virginia valeriae			X	
Eastern hognose snake				
Heterodon platyrhinos		X	X	X
Northern Ringneck snake				
Diadophis punctatus		X	X	
Eastern worm snake				
Carphophis amoenus		X	X	

Table 3: Reptiles (continued)

Name	Dunes and Barrier Beach Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Northern black racer					
Coluber constrictor	X	X	X	X	X
Rough green snake					
Opheodrys aestivus			X	X	X
Corn snake					
Elaphe guttata			X	X	X
Black rat snake					
Elaphe obsoleta			X	X	X
Northern pine snake					
Pituophis melanoleucus			X		
Eastern kingsnake					
Lampropeltis getulus			X	X	X
Eastern milksnake					
Lampropeltis triangulum			X	X	X
Northern scarlet snake					
Cemophora coccinea			X		
Timber rattlesnake (Threat.)					
Crotalus horridus			X	X	
Total coastal zone upland reptiles	31	4	13	29	23	12

source: Applegate (1974)

Table 4: Habitat preference of amphibians regularly occurring in the uplands of the New Jersey coastal zone

Name	Coastal Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Marbled salamander					
Ambystoma opacum		X	X	X	
Spotted salamander					
Ambystoma maculatum		X		X	
Eastern tiger salamander					
Ambystoma tigrinum (Endang.)		X	X		
Red-spotted newt					
Notophthalmus viridescens		X	X	X	
Northern dusky salamander					
Desmognathus fuscus		X		X	
Eastern redbacked salamander					
Plethodon cinereus			X	X	
Slimy salamander					
Plethodon glutinosus				X	
Four-toed salamander					
Hemidactylium scutatum		X		X	
Northern red salamander					
Pseudotriton ruber		X	X	X	
Eastern mud salamander					
Pseudotriton montanus		X			
Northern two-lined salamander					
Eurycea bislineata		X		X	

Eastern spadefoot					
Scaphiopus holbrooki		X		X	
American toad					
Bufo americanus		X		X	X
Fowler's toad					
Bufo woodhousei fowleri	X	X	X	X	X
Northern cricket frog					
Acris crepitans		X	X	X	X
Northern spring peeper					
Hyla crucifer		X	X	X	X
Pine barrens treefrog (Threat.)					
Hyla andersoni		X	X		
Northern gray treefrog					
Hyla versicolor		X		X	
Southern gray treefrog					
Hyla chrysoscelis		X	X		
Barking treefrog					
Hyla gratiosa		X			
Upland Chorus frog					
Pseudacris triseriata feriarum		X	X	X	X
Bullfrog					
Rana catesbeiana		X		X	X

Table 4: Amphibians (continued)

Name	Coastal Uplands	Freshwater Wetlands	Pine Barrens	Hardwood Forests	Fields and Meadows
Carpenter frog					
Rana virgatipes		X	X		
Green frog					
Rana clamitans		X		X	X
Leopard frog					
Rana pipiens		X	X	X	X
Pickerel frog					
Rana palustris		X		X	X
Wood frog					
Rana sylvatica		X		X	
Total coastal zone upland amphibians	27	1	25	13	20	9

source: Applegate (1974)

Table 5. New Jersey game species regularly found in the uplands of the coastal zone.

Mammals:	Birds:
Eastern cottontail	Canada goose
Grey squirrel	Mallard
White-tailed deer	Black duck
Beaver*	Gadwall
Woodchuck	Pintail
Muskrat*	Green-winged teal
Raccoon*	Blue-winged teal
Mink*	American widgeon
Red fox*	Shoveller
Grey fox*	Wood duck
	Redhead
	Canvasback
	Greater scaup
	Lesser scaup
	American Golden-eye
	Bufflehead
	Ruddy duck
	Hooded merganser
	American merganser
	Red-breasted merganser
	Ruffed grouse
	Bobwhite
	Ring-necked pheasant

King rail

Sora rail

Common gallinule

American coot

American woodcock

Common snipe

Common crow

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*Furbearers, harvest controlled by trapping regulations.

Table 6: Estimated statewide harvest of game by hunters and trappers in the 1974-1975 season.

Hunted species	Number taken
Deer	13,147
Pheasant	457,818
Rabbit	777,415
Squirrel	227,603
Quail	290,843
Grouse	37,281
Woodcock	100,033
Duck	257,121
Canada Goose	30,225
Clapper Rail	22,761
Trapped species	
Muskrat	472,000
Raccoon	15,000
Fox	6,000
Mink	700
Beaver	87
Skunk	1,200
Opossum	10,000
Weasel	230

Source: New Jersey Department of Environmental Protection (1975)

Table 7: Calculated percent of licensed hunters hunting each game species (1974-1975 season).

Species	Percent
Deer	72.8
Pheasant	75.4
Rabbit	71.1
Squirrel	31.8
Quail	34.2
Grouse	34.5
Woodcock	19.8
Duck	22.5
Canada Goose	11.8
Brant	6.2
Clapper Rail	1.8
Bear	2.7

Source: New Jersey Department of Environmental Protection (1975)

APPENDIX C

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REFERENCES

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